🔁 Repeated Questions from PYQs of Power Plant Instrumentation

| No. | Repeated Question | Frequency (No. of Papers) | Units |
|---|---|---|---|
| 1️⃣ | Explain the importance / objectives of instrumentation and control in power generation. | 4 | Unit 1 |
| 2️⃣ | Classify conventional and non-conventional energy sources with examples. | 3 | Unit 1 |
| 3️⃣ | Explain boiler feed water circulation and control. | 4 | Unit 2 |
| 4️⃣ | Explain 3-element drum level control with neat sketch. | 4 | Unit 2 |
| 5️⃣ | Explain air-fuel ratio control in boiler. | 3 | Unit 2 |
| 6️⃣ | Explain flue gas oxygen analyzer / flue gas analysis system. | 3 | Unit 2 |
| 7️⃣ | Describe instrumentation and control in air-fuel circuit. | 3 | Unit 2 |
| 8️⃣ | Explain turbine monitoring and control system. | 4 | Unit 3 |
| 9️⃣ | Explain lubrication and cooling system of turbo-alternator. | 4 | Unit 3 |
| 🔟 | Explain turbine speed and vibration measurement. | 3 | Unit 3 |
| 11. | Compare CWR, PWR, and BWR nuclear reactors. | 4 | Unit 4 |
| 12. | Explain safety and safety-related systems in nuclear power plant. | 3 | Unit 4 |
| 13. | Explain layout and instrumentation of nuclear power plant. | 3 | Unit 4 |
| 14. | Explain working / instrumentation of hydroelectric power plant. | 3 | Unit 5 |
| 15. | Explain voltage and frequency regulation in hydro power plant. | 2 | Unit 5 |
| 16. | Explain pollution and effluent monitoring system in power plant. | 2 | Unit 5 |
| 17. | Explain energy management in power plant. | 2 | Unit 5 |
| 18. | Explain electrical substation control and protection. | 2 | Unit 5 |
| 19. | Compare thermal and nuclear power plant. | 2 | Unit 1 & 4 |
| 20. | Compare thermal and hydro power plant. | 2 | Unit 1 & 5 |

🧩 Most Frequently Asked (Top 10 GTU-Repeat Questions)

> These appeared in almost every paper (high-probability for next exam)

1. Importance of instrumentation in power generation.

2. Boiler feed water circulation and control.

3. 3-element drum level control system.

4. Air-fuel ratio control in boiler.

5. Turbine monitoring and control.

6. Turbine lubrication and cooling system.

7. Compare CWR, PWR, and BWR reactors.

8. Safety and safety-related systems in nuclear plant.

9. Instrumentation in hydroelectric power plant.

10. Pollution and effluent monitoring system.

## ⚡ CHAPTER 1: Introduction to Power Plant Instrumentation

(4 Hours – Basic & Conceptual Unit)

### 🌟 Very High Probability Questions

1. Explain importance/objectives of instrumentation and control in power generation.

2. Classify and compare conventional and non-conventional energy sources.

3. Draw and explain a block diagram or layout of a thermal power plant.

4. Explain piping and instrumentation diagram (P&ID) for a typical power plant.

5. What factors are considered while selecting the site for a power plant?

### 🧠 Important Topics

Conventional vs Non-conventional sources (coal, hydro, nuclear, solar, wind)

P&ID symbols and purpose

Role of instrumentation in efficiency, safety, and automation

Energy management basics

---

⚙️ CHAPTER 2: Instrumentation and Control in Water & Air-Fuel Circuits

(8 Hours – Most Asked Unit in GTU)

🌟 Very High Probability Questions

1. Explain boiler feed water circulation and control system.

2. Explain 3-element drum level control system with neat sketch.

3. Explain air-fuel ratio control in boiler.

4. Explain flue gas analysis system / flue gas oxygen analyzer.

5. Describe impurities in water and steam and their effect on boiler performance.

6. Explain analytical measurement instruments used in air-fuel circuits.

7. Explain boiler draft control (ID, FD fans).

🧠 Important Topics

Water circuit: feedwater pump, economizer, deaerator

Drum level (1, 2, 3-element) control logic

Air-fuel ratio and combustion control

Analytical instruments ($O_2$, $CO_2$, $NO_x$ analyzers)

Impurity measurement (conductivity, pH, dissolved oxygen)

Interlocks in boiler

---

⚙️ CHAPTER 3: Turbine Monitoring and Control

(8 Hours – Most Repeated in 4 PYQs)

🌟 Very High Probability Questions

1. Explain turbine monitoring and control system.

2. Explain turbine speed, vibration, and temperature measurement.

3. Explain lubrication and cooling system of turbo-alternator.

4. Explain turbine steam inlet and governing system.

5. Explain turbine protection interlocks and alarms.

6. Describe cooling system used in thermal power plant.

🧠 Important Topics

Classification of turbines (impulse vs reaction)

Steam flow measurement

Vibration and speed sensors (tachometer, accelerometer)

Lubrication and bearing temperature monitoring

Cooling methods (air, oil, hydrogen cooling)

Turbine control loop (pressure, flow, temperature)

---

☢️ CHAPTER 4: Nuclear Power Plant Instrumentation

(8 Hours – Conceptual + Control-Oriented)

🌟 Very High Probability Questions

1. Compare CWR, PWR, and BWR nuclear reactors.

2. Explain layout and instrumentation of a nuclear power plant.

3. Explain safety and safety-related systems in nuclear plant.

4. Explain role of instrumentation in reactor control and safety.

5. Explain nuclear power plant training simulator.

6. Explain plant communication and control systems in nuclear stations.

🧠 Important Topics

Reactor components and instrumentation

Neutron flux measurement, temperature, pressure control

Safety systems (SCRAM, containment, interlocks)

Control rod actuation and protection

Communication systems (operator-plant interface)

---

💧⚡ CHAPTER 5: Hydroelectric Plant, Energy Management & Safety

(8 Hours – Frequently Ignored but Likely This Time)

🌟 Very High Probability Questions

1. Explain layout and instrumentation of hydroelectric power plant.

2. Explain voltage and frequency regulation in hydro power plant.

3. Explain pollution and effluent monitoring system in power plant.

4. Explain energy management in power plant operation.

5. Explain electrical substation control and protection system.

6. Explain role of instrumentation in plant safety and energy optimization.

7. Compare hydro and thermal power plants based on efficiency and control.

🧠 Important Topics

Hydro plant layout, turbine (Pelton, Francis, Kaplan)

Governor control and excitation control

Effluent and pollution control (emission monitoring, analyzers)

Energy auditing and SCADA integration

Substation instrumentation: transformers, breakers, voltage regulators

Safety systems (alarms, interlocks, trip circuits)

---

🧾 🔥 Top 15 “High-Probability” Questions for Upcoming GTU Exam

(Selected by cross-analysis of all 4 PYQs + chapter trends)

1. Importance of instrumentation and control in power generation.

2. Boiler feed water circulation and control.

3. 3-element drum level control.

4. Air-fuel ratio control in boiler.

5. Flue gas analysis / Oxygen analyzer.

6. Turbine monitoring and control.

7. Lubrication and cooling system of turbine.

8. Turbine speed and vibration measurement.

9. Compare CWR, PWR, and BWR reactors.

10. Safety and safety-related systems in nuclear plant.

11. Layout and instrumentation of hydroelectric power plant.

12. Voltage and frequency regulation in hydro plant.

13. Pollution and effluent monitoring.

14. Energy management in power plants.

15. Electrical substation control and protection.